DESIGN UPDATE 3 -- 8/29/2006

Since our first design we've made many minor changes to key areas of the prayer bench, especially the folding hinge geometry. The *general* design remains the same, though the measurements and the order of assembly have changed. We've changed to pocket-screws and biscuits for almost all applicable joints, and made some measurement changes to allow for dovetail-style assembly and better actuation. The disadvantage of these improvements is that they require additional tooling -- pocket screw and dovetail jigs, and biscuit jointing cutters -- and some require greater woodworking skill and precision. But the results are worth the effort. These changes have resulted in a stronger, more attractive finished piece with greater functionality and long-term durability.

Before beginning, read through this update *and* the original plans. Both are necessary to complete the new design.

If you do not have pocket screw and biscuit joinery tooling, use the new piece sizes and drill locations from this update, but assemble them as directed in the original plans; and instead of pocket/frame screws and biscuits, use #8 wood screws.

NEW BILL OF MATERIALS

Qty	Description	Source
6'	1 x 8" Hardwood	Various
20'	1 x 6" Hardwood (Two 10' boards will suffice if without defect or bad snipe)	Various
2	1/4 20 x 35mm knockdown bolts with shoulders	Woodworker's Supply 812-628
2	1/4 20 x 70mm knockdown bolts with shoulders	Woodworker's Supply 812-529
2	1/4 20 knockdown nuts	Woodworker's Supply 812-620
2	1/4 20 x 13mm Type D hex drive threaded inserts	Woodworker's Supply 812-466
12-22	#7 or #8 1-1/4 inch fine thread pocket/frame screws	Various
4-20	Hole plugs (depending on how many and the type -- standard or pocket -- of holes you want to plug)	Various
2	2" diameter Wood Knobs (part number for oak ->)	Woodworker's Supply 938-692
2	3/8" o.d., 1/4" i.d., 1 to 1-1/2" length bushing	Hardware store
1	22-1/4" x 5-1/2" x 4" foam pad (optional)	Fabric/craft store
1	13" x 30" fabric (optional)	Fabric/craft store
26	Upholstery tacks (optional)	Woodworker's Supply 937-761
3-4	Small right angle brackets and screws less than 3/4" long	Various
8	1/2 to 3/4" diameter adhesive felt pads (optional)	Woodworker's Supply 933-692
2	#20 Biscuits	Various

COMPLETE CHANGE LIST

1. The folding kneeboard subassembly has been widened *slightly*.
2. The joint pins are now reinforced with bushings, do not require any thread cutting, and have an attractive wood knob on the end. The threaded wood knobs can be tightened to keep the kneeboard subassembly up during transport.
3. The joint pin location has moved, simplifying the fabrication of the kneeboard subassembly.

4. All end-grain screws have been discontinued and are replaced with stronger pocket screws. The general order of assembly has changed to take advantage of the pocket screw system. (You can still use standard screwing by following the screw patterns and assembly process in the original plans.)
5. *General* order of assembly for dovetail joinery methods.
6. The kneepad is attached to a floating board rather than affixed directly to the kneeboard subassembly, allowing for easy replacement or repair.
7. Kneeboard subassembly can now be permanently locked in the down position by adding two hidden pocket screws.
8, Biscuits are *strongly* recommended instead of pocket screws in at least two locations to avoid possible board end-splitting.

SAFETY

All of the safety points in the original design instructions apply equally here.

TOOL LIST

The tool list is the same as in the original plans, with the recommended addition of the complete Kreg pocket screw jig set (or similar product), a biscuit cutter and tooling for dovetails if you wish to try your hand at them.

WOOD PREP AND INITIAL CUTS

The preparation and cutting *process* is similar to the original design. Only the lengths vary slightly for some boards. See the new cut list.

The tolerances are *much* tighter on this model. Your cuts must be as square as you can make them. Tune and square your saw before beginning; *do not* trust your saw manufacturer's claim that your saw was squared at the factory! When we checked our new shop table saw we discovered that almost every axis and stop was off by as much as two degrees.

Make sure your blade is sharp.

If you have good sanding equipment it can save a *lot* of time to sand all boards with 150 grit on a drum or belt sander prior to cutting and assembly.

See the cutting diagram. Cut the upright sides and shelf pieces from one 1 x 6 x 10'. Cut the remaining 1 x 6 pieces from the other 1 x 6 x 10'. If your wood is not clear, you may need additional boards. Cut the top and side bases from your 1 x 8.

Perform miter cuts on feet, upright sides and shelf back as in original plans (10.3 degrees).

If your lumber is not 3/4" thick, you will need to adjust the plan measurements accordingly. The hinge geometry in particular is affected if the base cross-brace is anything except 3/4" thick, as are the widths of any horizontal boards.

CUT LIST

Component	Standard Model	Double	Dovetail Mod.
Top	1 x 8 x 26"	+24" (50")	- 1 1/2"
Two Side Bases	1 x 8 x 16"	Same	Same
Two Sides	1 x 6 x 30"	Same	+ 3/4"
Shelf and Shelf Back	1 x 6 x 23"	+24" (47")	Cut to fit, ~23" long
Base Brace	1 x 6 x 24-1/2"	+24" (48 1/2")	Same
Two Feet	1 x 6 x 19-1/4"	Same	+ 3/4"
Kneeboard	1 x 6 x 22-1/4"	+24" (46 1/4")	Same
Kneeboard Support	1 x 6 x 22-3/4"	+24" (46 3/4")	Same

DRILLING, BORING AND ROUTING

Key drill and routing points are different from the original design.

1. Using a 25/64" bit and a drill press, drill *precisely* as shown in the diagram; upright sides, base sides and feet. If these points are not dead on and matching, the kneeler will not fold properly. We drill these pieces simultaneously in our shop to assure that they match.
2. If you want the kneeler to be height-adjustable, route 2" slots downward from the holes on the upright sides only (as in the original plans). Use a 3/8" straight bit and a routing table. Unlike the original design, no routing is necessary in the foot end.
3. ***DESIGN UPDATE:*** Using a 23/32" to 3/4" plunge/mortising router bit, plunge 3/32" to 1/8" into the inside of the upright sides, centered directly over the upper hole. This will countersink the inside knockdown nut, and eliminates a possible scratch in the side of the folding subassembly. If you made the kneeler height-adjustable by routing the slot as directed in step 2, above, this counterbore needs to be extended to cover the entire slot. This adjustment may require shortening your upper knockdown bolt with a hacksaw or using a 30mm one instead of the listed 35mm one.
4. Bore a 3/4 inch deep hole into the wood knobs (assuming yours are about 1 or more inches thick) using a 21/64" bit. A brad point or forstner style bit is best. Twist in the threaded insert. It should be a *very* tight fit. Glue it into place with superglue (or similar).

STANDARD ASSEMBLY

This section describes the assembly process of the standard (non-dovetail) design using pocket screw systems. Assembly is in a slightly different order than in the original design. If you are not using pocket screws, revert to the original instructions for screw location, clamping techniques and general assembly order, but use the revised board dimensions and hinge geometry.

Precise positioning of the pocket screws is generally not necessary. When being drilled into a board face, just make sure that the screw hole is at least an inch away from the edge to avoid splitting and to allow room for a driver. Note that some screws are driven into the board edges rather than the faces; handle these a little more delicately — do not overtighten — to avoid splitting your boards.

Good clamping is critical when using pocket screws. If your boards are not firmly clamped in the proper location and square *prior* to driving a screw, the screw can (and probably will) pull your boards out of place when driven. If this happens, remove the screw, optionally plug the holes (or replace the board entirely), drill a new pocket and do it over.

Piece locations are identical to the original design except for the kneeboard support board. See the diagram for the new location.

Glue is helpful but unnecessary (the strength primarily in the pocket screws).

1. Pre-drill all pieces for pocket screws as shown in the diagram. Some holes are optional. The only pieces that do not require any pre-drilling are the top, base sides and kneeboard support.

1a. *We recommend against using pocket screws to connect the foot to the kneeboard support board as shown in the original diagrams*. In some cases the boards are splitting due to the proximity of the screw to the end of the board. We now use biscuits and glue in this location. Counterbored (and plugged) screws, and inside right-angle braces are two options that could also work.

2. Attach the shelf back to the upright sides using four screws. Plug and trim the visible screw holes now if you wish. You won't be able to get a chisel in position to trim these plugs later in the assembly process.
3. Attach the top to the sides using four screws. The vertical screw from the shelf back to the top is optional -- install it if the top is warped. Plug and trim now if you wish to hide these holes.
4. Attach the shelf base to the upright sides using four screws underneath the board. Sometimes it is useful to add a fifth screw connecting the center of the shelf base to the shelf back if ei-

ther board is warped (or if you anticipate warp in the future).

5. Attach the feet to the kneeboard support with ~~four pocket screws~~ *biscuits and glue*. See the diagram.
6. The base subassembly is completed as in the original design (II.10-11 in the original plans) except that pocket screws are used. The cross brace edge with the screws should be on top for reasons that will be clear later. The face with the screws should face out/front.
7. Insert plugs in remaining screw holes as desired. The only board that *needs* them (aesthetically) is the base cross brace.
8. Trim and sand for finishing.
9. Continue with *finishing*...

DOVETAIL ASSEMBLY

This section describes the assembly process of the dovetail design, also using pocket screw systems. The dovetails force a different assembly order and slightly different lengths for some boards. It is beyond the scope of this guide to teach actual *dovetail* techniques. See your local woodworking store for related manuals, jigs and tools (we use the Leigh dovetail jig).

1. Dovetail and attach the top to the sides. Dovetail and attach the kneeboard support to the feet.
2. Trim the shelf back and base to fit the final span between the sides.
3. Pre-drill the shelf back, shelf base and base crossbrace for pocket screws.
4. Install the shelf back first, then the base. Sometimes it is useful to add a fifth screw connecting the center of the shelf base to the shelf back if either board is warped (or if you anticipate warp in the future). See the diagram for suggested locations.
5. Continue as with step 6, above, then go on to *finishing*...

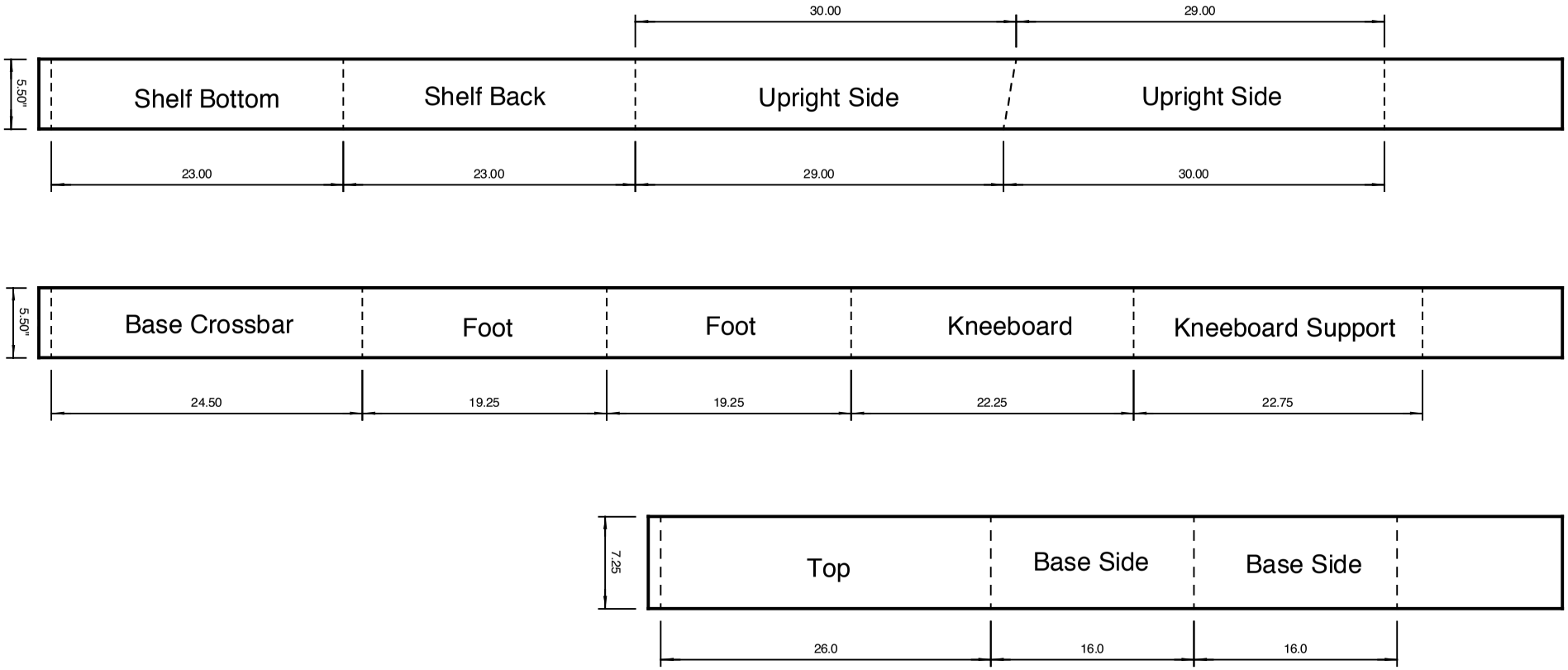
FINISHING

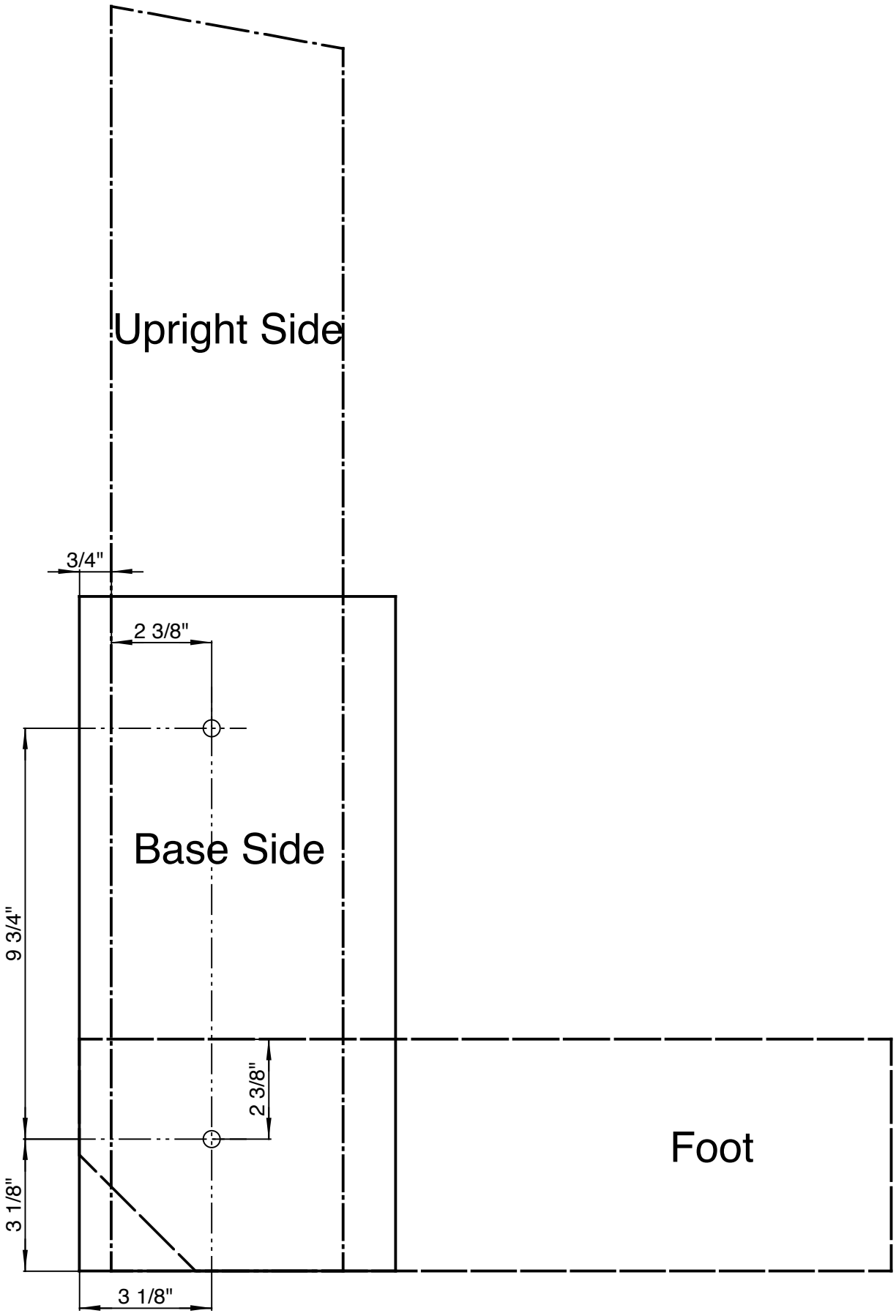
1. "Dry-assemble" all subassemblies and check for proper operation. See the original plans and final assembly changes, below, for details. If anything isn't working properly, it is much easier to address it prior to staining!
2. If everything checks out, finish/stain all pieces as in the original plans and per the application instructions for your finish.
3. Attach the kneepad to the kneeboard using techniques similar to those in the original plans. In the new design the kneepad is attached directly to a kneepad board, rather than to the entire kneeboard subassembly. The finished kneeboard/pad is then attached to the kneeboard subassembly using right angle brackets. This allows for easy removal and replacement of the kneepad if it becomes damaged.

FINAL ASSEMBLY NOTES

Final assembly is similar to the original plans, with these exceptions:

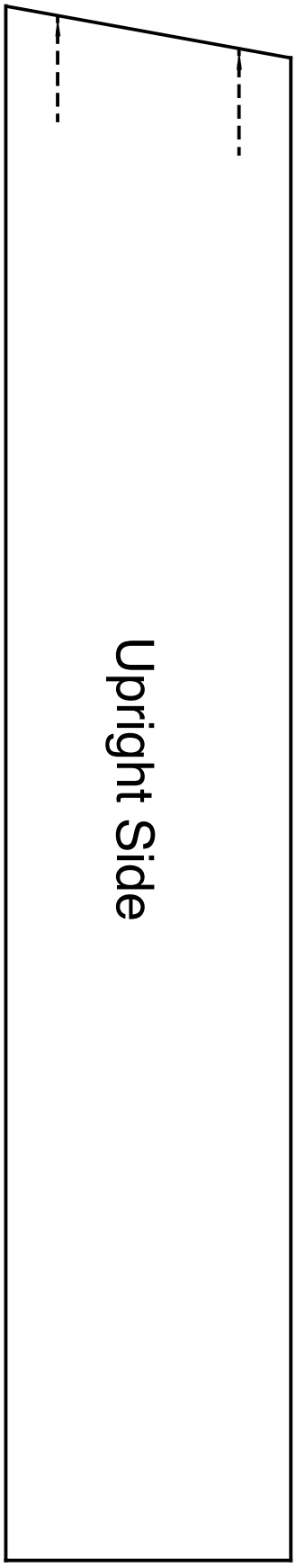
1. No thread cutting is necessary on the main joint pin. Just slide a bushing over the 70mm bolt. Push the bolt from the outside through the side base, upright side and foot end, then twist on the threaded knob. If all was cut and assembled accurately, there will be about 1/16" - 1/8" play between the kneeboard subassembly and the upright sides. You can insert a fender washer into this gap to keep the wood from rubbing together when folding the kneeler.
2. If you want the knee pad fixed in the down position (which helps with overall stability), drive a screw through the optional pocket holes in the 'nose' of the feet and into the base brace. This step will not be possible if the edge pocket screws on the cross brace are on the bottom edge of the cross brace unless you also have filled the hole with a solid wood plug (which might also create a mechanical weakness).

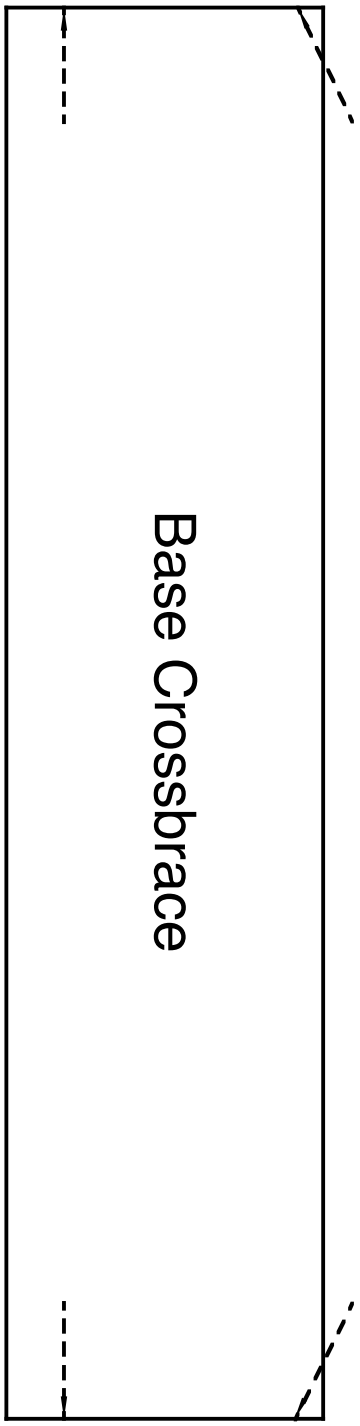

30.00
29.00
5.50"
Shelf Bottom
Shelf Back
Upright Side
Upright Side
23.00
23.00
29.00
30.00
5.50"
Base Crossbar
Foot
Foot
Kneeboard
Kneeboard Support
24.50
19.25
19.25
22.25
22.75
7.25
Top
Base Side
Base Side
26.0
16.0
16.0

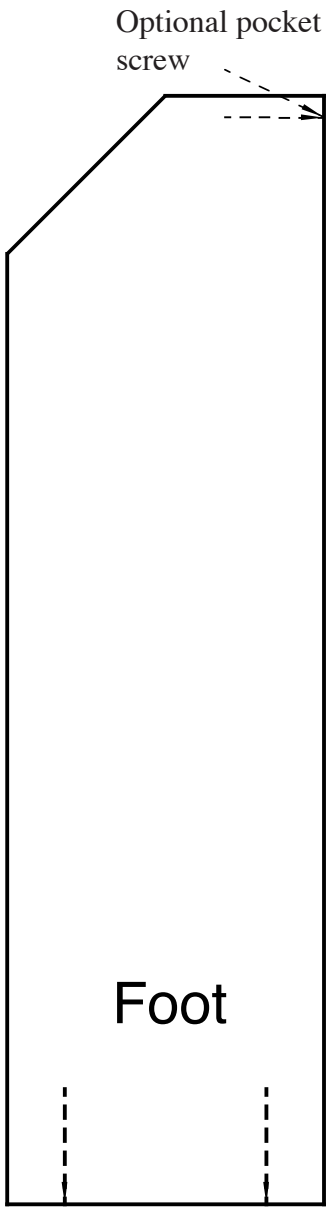

Upright Side
3/4"
2 3/8"
Base Side
9 3/4"
2 3/8"
Foot
3 1/8"
3 1/8"

Screws go into the interior faces of the upright side and the feet. Screws go into the top edge and front/outside face of the base crossbrace.

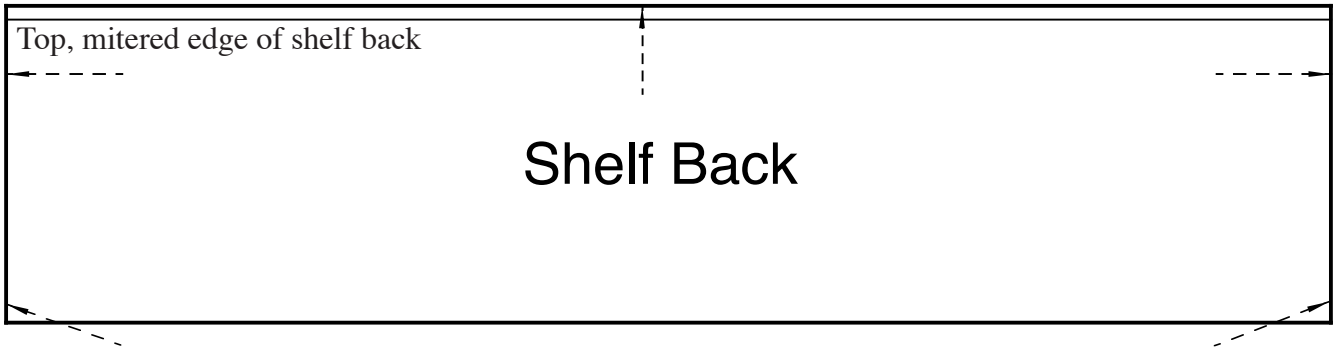
UPDATE: We now recommend biscuits instead of pocket screws in the end of the foot where it attaches to the kneeboard support.



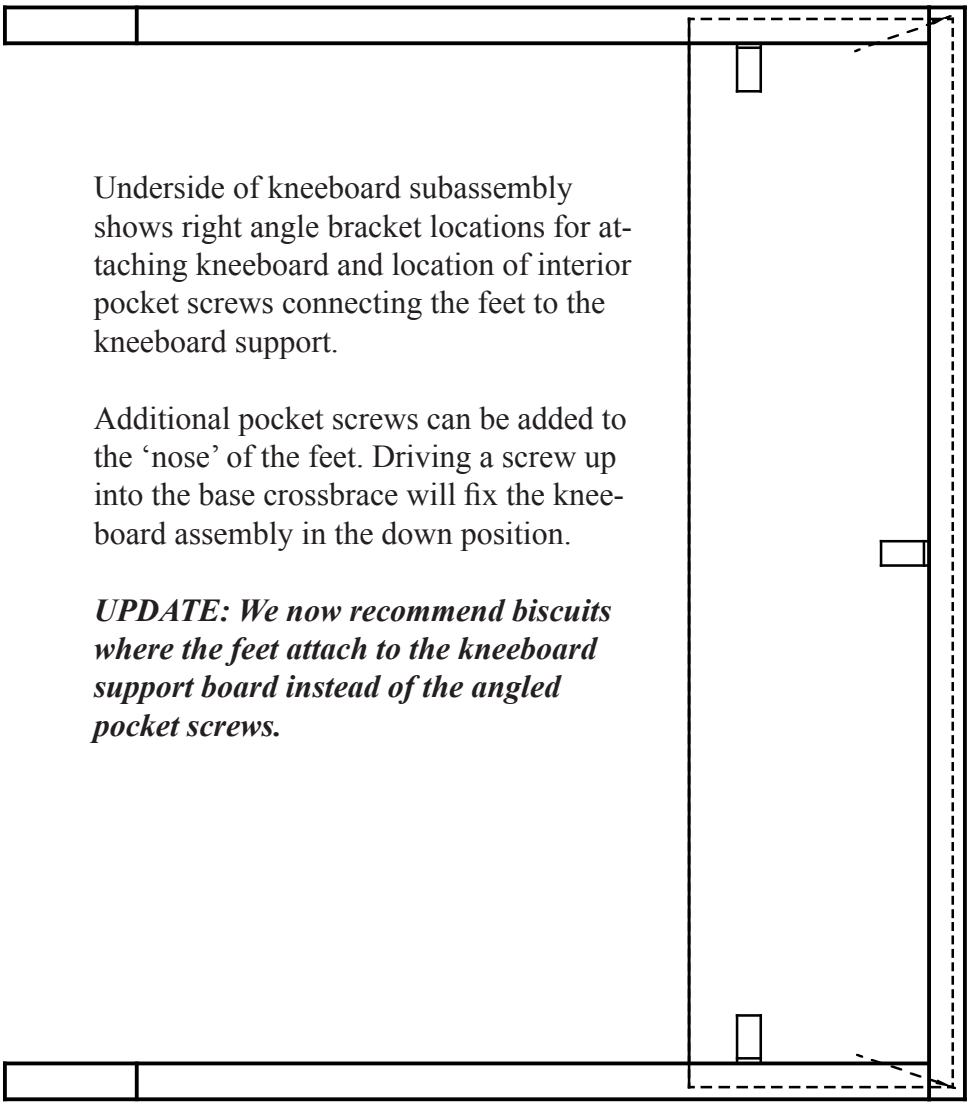




Top edge of shelf back, interior facing you. The vertical screw is optional; add it only if the top is significantly warped and the screw is needed to hold it down. The lower screws are going into the *edge* of the board, not the face.



Screws go into the bottom face of the shelf bottom.



Underside of kneeboard subassembly shows right angle bracket locations for attaching kneeboard and location of interior pocket screws connecting the feet to the kneeboard support.

Additional pocket screws can be added to the ‘nose’ of the feet. Driving a screw up into the base crossbrace will fix the kneeboard assembly in the down position.

UPDATE: We now recommend biscuits where the feet attach to the kneeboard support board instead of the angled pocket screws.

Side view of kneeboard subassembly showing butt joint and location of kneeboard support. Note the optional pocket screw in the ‘nose’ end of the feet. This screw can be drilled and added after complete assembly, if desired.